Potassium Chloride Injection Still Poses Threats to Patients

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PROBLEM: In the 1980s and 1990s, the Institute for Safe Medication Practices (ISMP), the U.S. Pharmacopeia (USP), the Joint Commission, and the Institute for Healthcare Improvement (IHI) drew much needed attention to the removal of concentrated potassium chloride (KCl) vials from patient-care areas. A 2002 Joint Commission National Patient Safety Goal sustained this effort, and virtually all U.S. hospitals have now removed the drug from floor stock on typical patient-care units.

The tragic errors that gave rise to this change were caused by knowledge deficits about the dangers of rapid intravenous (IV) administration of concentrated potassium or, more often, mental slips or selection errors that occurred when a staff member would grab a vial of medication. Although limiting access to KCl has reduced fatal errors, health care providers should not be complacent about the risks associated with this high-alert medication.

Lingering problems associated with concentrated KCl still pose serious threats to patients. Some examples follow.

Nurses have access to the pharmacy or night cabinet. In hospitals where 24-hour pharmacy services are not available, nurses may obtain medications from a night or weekend cabinet or from a discrete, secured area in the pharmacy. Vials of concentrated KCl may be available in these areas, increasing the risk that a nurse might accidentally select KCl in the attempt to obtain another medication.

Such an error occurred in a critical-access hospital and led to a patient's death. The patient was extremely short of breath, and his physician had prescribed an IV dose of furosemide (Lasix, Sanofi-Aventis). The pharmacy was closed, so a nurse entered the secured section of the pharmacy to obtain the drug. She mistakenly selected a vial of KCl instead of furosemide; both drugs were kept on nearby shelves just above the floor. She took the vial to the unit, withdrew the medication, and administered it to the patient. A mental slip—mistakenly associating "potassium" on the label with the potassium-excreting diuretic—likely resulted in the nurse's failure to recognize the error until she went back to the pharmacy to document removal of the drug.

Vials are dispensed for specific patients. Because the Joint Commission now prohibits vials of concentrated KCl from being stocked in patient-care areas, some hospitals now dispense vials of the drug, as needed, to be added to existing parenteral solutions for specific patients (especially pediatric patients). This dangerous practice exposes patients to the risk of receiving undiluted potassium if the nurse selects the wrong vial when preparing medications. The vial or an unlabeled syringe containing KCl could also be placed on the counter in common medication areas, exposing other patients to the risk of a similar error.

Vials are kept in specialty areas. Vials containing KCl are sometimes stocked in specialty areas such as the cardiac bypass surgical suite for use during surgery. However, the availability of concentrated KCl in the operating suite poses a risk of accidental IV administration of the undiluted drug.

Vials are stored in outpatient settings. During on-site hospital visits, our ISMP staff has occasionally found vials of concentrated KCl in hospital-associated adult ambulatory-care clinics and women's centers. KCl is used to prepare IV solutions or treatments, such as bladder instillations to diagnose interstitial cystitis (even though this has been considered a controversial practice in recent years). The presence of these vials represents a serious risk because some patients in these clinics also receive IV medications or solutions. In some cases, nurses did not know that the vials were in the clinic, further increasing the risk of an error.

Sometimes a clinic staff member might order KCl vials along with other medications and solutions directly through a wholesaler. In this situation, when the drug supplies reach the pharmacy, they might be delivered directly to the clinic without the pharmacy staff's awareness that the box contains vials of concentrated KCl.

Mixups occur in the pharmacy. The ISMP has received reports about serious errors that originated in the pharmacy. In one report relating to concentrated KCl, a pediatrician prescribed an IV infusion of 3.5 mEq of KCl for a 3.5-kg infant. Using the hospital's standard concentration of 0.2 mEq/mL, the pediatrician entered the order into the computer properly as 3.5 mEq/17.5 mL. The drug was typically withdrawn from a premixed 20-mEq/100-mL bag; however, a pharmacist inadvertently obtained the medication from a vial of concentrated KCl. A 35-mEq dose was drawn into a syringe labeled 3.5 mEq. The infant experienced ventricular tachycardia, which was treated successfully with cardioversion and amiodarone (Cordarone, Pfizer).

Patients have died as a result of similar errors. In one instance, a batch of dialysis solutions was prepared with a look-alike carton of KCl vials instead of sodium chloride vials.

SAFE PRACTICE RECOMMENDATIONS: Removing concentrated KCl vials from floor stock is not enough to prevent tragic errors with this high-alert medication. The following additional strategies should be considered:

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1. ***Failure mode and effects analysis (FMEA) should be performed.*** An inventory should be made of all concentrated electrolytes in the organization, and an FMEA should be performed. The look-alike potential of product containers should be evaluated. When possible, concentrated electrolytes should be purchased from different vendors to avoid the potential for mixups between the two vials because of their similar appearance.

2. ***Nursing access to the pharmacy should be prohibited.*** Nurses should not enter the pharmacy when it is closed. A discrete stock of carefully selected, after-hours medications, including premixed small and large volumes of KCl solutions, should be available in a secured area, preferably in a controlled-access cabinet.

3. ***Dispensing of vials should be prohibited.*** Vials of KCl should not be dispensed to prepare infusions by nurses on the patient's floor. Instead, the pharmacy should dispense premixed solutions or should prepare admixtures for patients as needed. Vials should not be provided as floor stock.

Some hospitals may make an exception for perfusionists in the cardiac bypass surgical suite, but many facilities have eliminated vials in all areas by providing premixed or pharmacy-prepared minibags of selected concentrations.

If vials are dispensed to a cardiac bypass surgical suite, they should carry bold auxiliary warnings. Upon delivery, two individuals should independently verify that the correct product has been received, that it is labeled properly with auxiliary warnings, and that it has been placed in the proper, secured storage area.

4. ***Premixed solutions should be used.*** Electrolyte replacement therapy should be standardized, and premixed solutions or commercially outsourced admixtures should be used whenever possible.

5. ***Electrolytes should be segregated and labeled.*** In the pharmacy, an inventory of bulk supplies of concentrated electrolytes should be made immediately. The electrolytes should be stored in an area away from other drugs and distinctly separated by product type. On all storage shelves and bins, warning labels should be affixed to mention the need to dilute these products.

6. ***Independent double-checks should be performed.*** A pharmacist should be enlisted to perform a final, independent check of all products used for IV admixtures of electrolyte solutions.

7. ***Drugs should be procured through the pharmacy.*** For clinics associated with hospitals, medications should be purchased through the pharmacy. All packages delivered to the pharmacy should be inspected before distribution to clinics.

8. ***Safety rounds should be conducted.*** Regular rounds at affiliated outpatient facilities and on inpatient units should be made to verify floor stock and to ensure safe storage of medications.

The reports described in this column were received through the ISMP Medication Errors Reporting Program (MERP). Errors, close calls, or hazardous conditions may be reported on the ISMP Web site (www.ismp.org) or communicated directly to ISMP by calling 1-800-FAIL-SAFE or via e-mail at ismpinfo@ismp.org. ■